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ABSTRACT

This study was intended mainly to examine the effects of class size on the reading and mathematics achievement of first graders and also to determine the effects of teacher inservice training on student achievement. Data were gathered from 25 pairs of first-grade classes from 23 South Carolina school districts. Each pair of classes was made up of one experimental and one control class of similar racial and socioeconomic background but different size. Experimental classes contained an average of 19.9 students, while control classes contained an average of 26.7 students. Approximately half of the 50 teachers received inservice training; within each pair of classes, either both teachers or neither teacher received inservice training. Results indicated that the overall achievement of first-grade students in small classes was substantially greater than overall achievement of students in large classes. However, neither teacher inservice training nor the interaction of class size and inservice training had any significant effect on overall achievement. (Author/JG)

South Carolina First Grade Pilot Project 1975-76: The Effects of Class Size on Reading and Mathematics Achievement

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Cyril B. Busbee, State Superintendent

SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1975-76:

THE EFFECT OF CLASS SIZE ON

READING AND MATHEMATICS ACHIEVEMENT

A Joint Effort of the

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Columbia, South Carolina
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THE OFFICE OF RESEARCH REPORT SERIES

SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1975-76: THE EFFECTS OF CLASS SIZE ON READING AND MATHEMATICS ACHIEVEMENT

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ABSTRACT

The primary purpose of the South Carolina First Grade Pilot Project 1975-76 was to examine the effects of class size on reading and mathematics achievement of first grade students. The secondary purpose was to examine the effects of teacher in-service training on student achievement. The analysis of the data was based upon 50 project classes located within 23 of South Carolina's 92 public school districts. These fifty classes consisted of 25 pairs of classes that were matched on racial composition of the student body, socioeconomic background of the students, and school curriculum. Within each pair of classes there were one experimental class (referred to as the small class) and one control class (referred to as the large class). The experimental class contained an average of 19.9 students, and the control class contained an average of 26.7 students. Approximately one-half of the project teachers received in-service training. Both the experimental and control class teachers for a given pair of classes either received in-service or did not receive in-service.

A summary of the findings with respect to the effects of class size and in-service training on reading achievement and mathematics achievement follows.

The reading achievement of first grade students in small classes was significantly higher than the reading achievement of first grade students in large classes. Although the amount of increase in scale score points for reading achievement was small, this increase was sufficient to be considered a "real" increase rather than a "chance" increase.

However, in mathematics the difference between the achievement of first graders in small classes and first graders in large classes was so small that these differences might have been the result of chance alone.

Although some teachers attended special in-service training sessions during the year, there was no evidence that in-service training alone affected the achievement of first grade students in reading or mathematics.

There was evidence that the combination of class size with teacher in-service training had an effect on the reading achievement of first graders. Students in large classes whose teachers received in-service training, students in small classes whose teachers did not receive in-service training, and students in small classes whose teachers received in-service training scored significantly higher than students in large classes whose teachers had not participated in the in-service training sessions. There was no evidence that any one combination of class size and teacher in-service training affected mathematics achievement more than the other possible combinations.

Additional questions concerning the effects of class size, teacher in-service training, and the interaction of class size and teacher in-service training on language and overall achievement were explored.

The results from the language achievement analyses indicated that class size, teacher in-service training, and the interaction of class size and teacher in-service training did not significantly affect the language achievement of first grade students.

The results from the overall achievement analyses indicated that the overall achievement of first grade students in small classes was significantly greater than the overall achievement of first grade students in large classes. However, neither teacher in-service training nor the interaction of class size and teacher in-service training had any significant effects on overall achievement.

In general, the pilot project demonstrated that reading achievement and overall achievement of first graders were increased as a result of reducing class size. Additional information which may affect future decisions on reducing class size will be forthcoming from the second year evaluation of the project which is presently in progress.

CHAPTER I

NATURE OF THE INVESTIGATION

Introduction

The South Carolina Legislature allocated $250,000 to be used in a pilot program to reduce the pupil/teacher ratio in first grade classes throughout the State. These funds were appropriated to the State Department of Education in the South Carolina General Appropriations Act for the Fiscal Year 1975-76, Section 29, Item IV B. The Office of General Education, Division of Instruction, was responsible for determining the allocation of funds under this program. The Office of Research, Division of Administration and Planning, was responsible for development and implementation of the project design and the evaluation of the programmatic effects.

Purpose of the Study

The primary purpose of this study was to investigate the effects of class size on student achievement. Two secondary purposes were: (1) to investigate the effects of teacher in-service training on student achievement and (2) to investigate the combined effects of class size and teacher in-service training on student achievement. Therefore, this study attempted to provide answers to the following research questions:

1. What effect does class size have on the reading achievement of first grade students?
2. What effect does teacher in-service training have on the reading achievement of first grade students?

3. What effect does the interaction of class size and teacher in-service training have on the reading achievement of first grade students?

4. What effect does class size have on the mathematics achievement of first grade students?

5. What effect does teacher in-service training have on the mathematics achievement of first grade students?

6. What effect does the interaction of class size and teacher in-service training have on the mathematics achievement of first grade students?

Review of Literature

The results of the research investigating the effects of class size on student achievement fall into three major categories. The first category contains studies in which class size did not make a difference in student achievement. The second category contains studies in which the achievement of students in large classes was higher than the achievement of students in small classes. The third category contains studies in which the achievement of students in small classes was higher than the achievement of students in large classes.

Studies in Which Class Size Did Not Make a Difference

There is support in the literature for the view that class size does not make a difference in student achievement. In 1973, the New York State Department of Education published a manual for administrators in an attempt to identify general trends in research related to improving student academic performance. In 37% of the 19 studies reviewed, class size was significantly related to what was referred

to as the "ability of schools to educate students" (p. 12). In the non-cognitive area, class size was not a significant factor in any of the four studies reviewed. Although class size did appear to be a significant variable in approximately 42% of the 12 studies reviewed in the cognitive area, this evidence was not strong enough to warrant support for the contention that class size is a significant determinant of student academic success.

The Division of Research and Development of the Cleveland Public Schools in Ohio conducted a three year (1970-72) longitudinal study titled the "More Effective Schools Program (MES)", which was designed to improve poor achievement across all grades in a given school (Taylor & Fleming, 1972). The MES classes were characterized by an increase in individualization of instruction accomplished by reducing the average class size in participating schools to 25 students and by implementing several instructional improvements. In the longitudinal analysis of the data, three groups were investigated:

Grade 1-2: Children who entered the program in the first grade, second year of the project, and were compared in the second grade, third year of the project.

Grade 2-3-4: Children who entered the program in the second grade, first year of the project, and were compared in the fourth grade, third year of the project.

Grade 4-5-6: Children who entered the program in the fourth grade, first year of the project, and were compared in the sixth grade, third year of the project.

The reading and mathematics subtests of the Stanford Achievement Tests were used to measure achievement in these content areas. The project data were analyzed longitudinally for these three samples of students over a period of three years. In Year 2, the only significant

differences observed favoring the MES group were in reading for the Grade 4-5-6 sample. In mathematics the only significant differences favoring the MES group occurred in the Grade 1-2 sample. The control groups scored significantly higher in mathematics in the Grade 2-3-4 sample. No significant differences in mathematics achievement occurred in the Grade 4-5-6 sample. In Year 2, the Grade 2-3 MES sample was superior to the control group in reading but lost its superiority in Year 3. In Year 2, the Grade 4-5-6 sample was superior to the control group in both reading and mathematics; however, in Year 3, the Grade 4-5 sample was only superior in reading. The results of the longitudinal analyses were based only on those students who remained in the study over the three year period. This factor might have biased the results. Thus, class size in conjunction with other factors that were thought to affect achievement did not appear to make a consistent difference over time in the reading and mathematics achievement of the sample students.

Studies Favoring Large Class Size

Support for the position favoring large class size is evidenced in a study by Madden (1968) in which the effect of class size on ninth grade mathematics achievement was examined. The Contemporary Mathematics Test, Junior High School Level, was administered to large classes containing 75 to 85 students and to small classes containing 25 to 40 students. Based on his analysis, Madden concluded that ninth graders in large classes performed significantly higher in general mathematics than students in small classes; and, furthermore,

that students of average ability in large classes performed significantly higher in general mathematics than students of average ability in small classes.

In a more recent study, Irving Flinker (1972) examined the effects of class size on the mathematics and English achievement of seventh grade students. Three classes of seventh grade students at George Gershwin Junior High School 166 in Brooklyn, New York, were involved in the study. The students were ranked according to their performance on the Metropolitan Achievement Test in Reading, Form BM, and then assigned to one of three classes so that the three classes could be matched on student reading ability. One class contained 55 students, and the other two each contained 34 students. Additionally, an attempt was made to match the classes on course content and quality of instruction. Forms A and B of the Metropolitan Achievement Test in Mathematics were administered in October, 1970, and June, 1971, respectively. The same form of the New York State Junior High School Survey Test in English was administered in January, 1971, and June, 1971, respectively. On the basis of his results, Flinker concluded that large class size in the seventh grade was conducive to the development of mathematics and English skills. Flinker acknowledged two extraneous factors in his study that could have influenced his results. First, the teacher of the large class was also head of the mathematics department in the school; and, second, the teacher of the large class received assistance from a paraprofessional. Because of the quality of instruction present in the large class, Flinker conjectured that having an excellent teacher in a large class tended

to produce better results than having an average teacher in a small class. Since the design of Flinker's study did not adequately control for quality of instruction and paraprofessional assistance, the results observed could not be attributed to the effects of the class size variable alone.

Studies Favoring Small Class Size

There are several studies which support the contention that small class size is significantly related to student achievement. One of the earlier and most comprehensive studies is a study conducted by Furno and Collins (1967) over a five year period (1959-1964). Furno and Collins investigated the relationship between class size and the reading and mathematics achievement of third grade students. In 1959, data were collected on 16,449 third graders in the Baltimore public schools. These students were grouped by class size into four class size categories: 25 or less, 26 to 31, 32 to 37, and 38 or more. The Metropolitan Elementary Reading and Arithmetic Tests, Stanford Elementary Reading and Arithmetic Tests, and Stanford Intermediate Reading and Arithmetic Tests were used to assess gains in achievement over the five-year period. Seventy-eight percent of the comparisons favored students in smaller classes. Nonwhite students seemed to benefit more from the smallest class size than white students as evidenced by the fact that, in 66% of the comparisons between larger and smaller class achievement gains, the comparisons favored the nonwhite students. Murphy (1975) in his review of the literature agreed that in general the study favored the smaller class sizes; however, he observed that the achievement comparisons of class size groups of 25 with class

size groups of 31 were not as definitive. He noted that 10 comparisons for reading and arithmetic favoring the smaller class size group were derived from white students in the two lowest intelligence groups (IQ's of 79 and below and IQ's of 80 to 94). For the total reading and arithmetic comparisons for white students with IQ's of 95 and above, one comparison favored the smaller group, three comparisons favored the larger group, and four comparisons favored neither group. Murphy concluded:

> It seems reasonable to suspect, therefore, that differences in achievement between class size groups of 25 and class size groups of 31 are attributable more to differences in intelligence than differences in class size (pp. 24, 26).

Balow (1969) conducted a longitudinal study, the results of which also favored small class size. Balow observed the reading achievement of the same sample of students from grade one to grade four. For a period of two or more years, students in class sizes of 15 scored significantly higher in reading achievement than students in class sizes of 30. Balow concluded that a positive relationship between small class size and student reading achievement existed when a given sample of students remained in small classes over a period of two or more consecutive years. He speculated that class size was critical to reading in the first grade because learning patterns had not been established; however, by the third grade the advantages of class size were negated by differences in individual learning patterns.

Additional support for the position favoring small class size was reported by Woodson (1968) in a study in which the overall class size policy for 95 school districts was compared with achievement of

students in grades four through six. Residual scores, the difference between an actual score on a standardized test and a score predicted from an intelligence test, were used as the measures of achievement. Woodson used correlational analyses in obtaining the following related results:

1. The relationship between class size and student achievement was not consistent for pupils with different academic abilities. Significant correlations, which existed only for low ability students (Otis IQ's of 85 or less), indicated that an inverse relationship existed between achievement of low ability pupils and class size. This evidence was not sufficient to conclude that "the scholastic achievement of the lower ability pupil was influenced to a greater extent by the size of the class in which he studies than was the achievement of the student of higher academic potential (p.3)".

2. The correlations indicated that there was generally no significant relationship between class size and reading or mathematics achievement.

3. The mean score of students in districts in the lower third of the class size range were higher; however, significant differences between mean scores were observed only in the fourth grade.

Murphy (1975) presented several problems that existed in this study. First, the findings were not generalizable because the sample of school districts was not randomly selected. Second, the teacher variable was not controlled. Third, districts with class sizes of 22 students might possess characteristics which are different from the characteristics of districts with class sizes of 27 students.

Olson (1971) found in a recent study that class size was important to overall success in the classroom. In reference to Olson's study, the following statement was made in Phi Delta Kappan:

> At last a researcher with impeccable credentials claims unqualified answers to certain perennial questions (p. 63).

Olson's study was noteworthy in that educational quality was measured by classroom processes and not by student performance on a standardized test. This study extended the research of Bernard McKenna (which was conducted 14 years earlier in 1957) to almost 20,000 classrooms across the country. The major intent of the Olson study was to answer some of the major questions that have been of concern to educators. One of the questions that he attempted to answer in his study was: "What effects do class sizes of 5, 15, 25, and 36 have on educational quality in the classroom?" (p. 63). One-hundred-twelve school districts located in 11 large northern and midwestern metropolitan areas participated. Olson used Indicators of Quality, which has been demonstrated to be highly reliable and valid for measuring the overall quality of the classroom educational process. The indicators assessed classroom processes on the basis of four criteria: individualization, interpersonal regard, group activity, and creativity. Observation teams using standardized forms visited classrooms in order to measure the classes on these four criteria. Olson found that class size was one of the variables observed to be highly predictive of the quality criterion. He further found that smaller class sizes were consistently and significantly related to the quality criterion. Olson concluded:

> With little question, it would be well for school systems to consider altering their class size ratios if close to and on the wrong side of a critical breakpoint, such as 26-1 ratio in elementary, or 16-1 in secondary. However, to expend school funds to lower just any existing ratio by one or two students seems entirely unjustified in view of this evidence (pp. 64-65).

Olson defined critical breakpoint as that point at which there was a drop in scores on the quality criterion between class sizes, for instance, between a class size of five and under and a class size of five to 10. Olson noted that, since the selection of the sample was nonrandom, the results were only generalizable to the population under investigation. Nevertheless, he noted that the findings should be operationalized to other public school systems for the purpose of discussion and further investigation. In most class size research student achievement as measured by a standardized test is used as the single indicator of quality; however, in this study achievement on a standardized test was not included as one of the indicators of classroom quality.

In a review of the literature, Olson and McKenna (1975) found further evidence to support their findings on the positive effects of small class size. On the basis of their review, Olson and McKenna made the following generalizations which support the contention that small class environments are conducive to learning:

1. Teachers employ a wider variety of instructional strategies, methods, and learning activities and are more effective with them.
2. Students benefit from more individualized instruction.
3. Students engage in more creative and divergent thinking processes.
4. Students learn how to function more effectively as members and leaders of groups.
5. Students develop better human relations with and more regard for other students and their teachers.
6. Students learn the basic skills better and master more subject matter content.

7. Classroom management and discipline are better.

8. Teacher attitude and morale are more positive.

9. Student attitudes and perceptions are more positive (pp. 1-2).

These generalizations were based on a review of approximately 60 studies. The authors did point out that in some of the studies there was little difference between the definitions of large and small classes; however, they concluded that "for a great range of important educational goals and processes, reflected in the generalizations, fewer is unquestionably better than more" (p. 1).

In one of the most recent studies, Moody, Baussel, and Jenkins (1973) obtained results that definitely favored a reduction in class size. The study was experimental in that the class size variable was manipulated by the researchers. Eighty-three fourth-grade students were randomly selected to participate in the study from each of three public schools in a Northern Delaware school district for a total of 249 subjects. Within each of the three schools, the 83 students were randomly assigned to one of four treatment groups. The four treatment groups consisted of four different instructional techniques each of which was designed for teaching a common set of 10 mathematics objectives. Three of the groups contained 20 subjects, while the fourth group contained 23 subjects.

Group 1-1: Each student was instructed individually by one teacher for a total of 20 instructional trials.

Group 1-2: Two students were instructed simultaneously by one teacher for a total of 10 instructional trials.

Group 1-5: Five students were instructed simultaneously by one teacher for a total of four instructional trials.

Group 1-23: All 23 students were instructed simultaneously by one teacher for a total of one instructional trial.

Regardless of the teacher/pupil ratio, each trial lasted 30 minutes. The teachers in the study were volunteer junior and senior elementary education majors. Although the teachers were not randomly assigned to schools, the teachers were randomly assigned to a particular treatment group. The pretest and posttest consisted of 20 items designed to measure the 10 mathematics objectives. The mathematics achievement for Group 1-1 was superior to the mathematics achievement of the other three treatment groups. There was no difference in mathematics achievement observed between Group 1-2 and Group 1-5. However, both Group 1-2 and Group 1-5 were significantly superior to Group 1-23 in terms of mathematics achievement. The authors concluded that a reduction in class size did make a difference in mathematics achievement when the class size was reduced from an average class size standard.

The results of the 1972 National Education Association (NEA) Opinion Poll indicated that 60% of the teacher respondents rated "working with too many students each day" in the category "moderate, serious, or critical problem". In the 1975 NEA Opinion Poll, teachers again expressed concern about class size. In the questionnaire teachers were asked, "If you could make one change that you think would improve your own morale or professional satisfaction as a teacher, what would the change be?". Lower class size was the second most-frequent response given by the teachers, and approximately eleven percent of the teachers selected this response.

The following remarks made by teachers in the Atlanta school system provide evidence that teachers feel that learning in a class-

room environment could be facilitated by reducing class size (Perrimon, Bowen, Payne, & Johnson, 1976):

> I am a sixth grade teacher at the Woodson Elementary School in Atlanta, and I have 39 students. The preceding afternoon, three children in my classroom asked for special help. I told them to wait, that I was working with some others but would be with them in a few minutes. Those few minutes never came.....I was simply unable to spread myself thin enough to attend the needs of all my 39 children (p. 39).

> My principal often tells me, 'you're one of my best teachers; I know you can handle it.' What he's referring to is the large number of children I have in my classroom. Sure, I can handle them. I could handle three times as many, and so could most teachers. But handling children is not what teaching is all about (p. 40).

> Now, after several years of teaching and of talking with and observing other teachers, I realize that all of us are crowding in sheer numbers of students. The only alternative to having fewer students is to lower your goals - and many teachers have done this (p. 42).

Summary of the Literature Review

The effect of class size on pupil achievement has been a research topic of widespread interest during the past 50 years. Both teachers and school administrators contend that a reduction in class size would reduce the teacher load and thereby allow the teacher more time to spend with individual students. Many studies have been conducted to assess the effect of class size on pupil achievement; however, to date the research has been inconclusive. The general sentiment in the literature is that there is no ideal class size that can be globalized to all subjects, grade levels, and modes of instruction. On the contrary, class size is considered to be situation-specific, for in some cases, a large class size results in higher achievement levels than a small class size. In spite of the fact that research

on class size has not yielded conclusive results, teachers still contend that class size is a critical problem. Given the research to date the most appropriate approach to the problem is to examine the problem in a specific situation and control variables that could influence the dependent variable, student achievement.

Hypotheses

Because of the inconclusiveness of the existing class size research, the following null hypotheses were formulated:

Hypothesis I: There will be no difference in the reading achievement of first grade students in small classes and first grade students in large classes.

Hypothesis II: There will be no difference in the reading achievement of first grade students whose teachers did receive in-service training and first grade students whose teachers did not receive in-service training.

Hypothesis III: There will be no difference in the reading achievement of first grade students as a result of the interaction effect of class size and teacher in-service training.

Hypothesis IV: There will be no difference in the mathematics achievement of first grade students in small classes and first grade students in large classes.

Hypothesis V: There will be no difference in the mathematics achievement of first grade students whose teachers did receive in-service training and first grade students whose teachers did not receive in-service training.

Hypothesis VI: There will be no difference in the mathematics achievement of first grade students as a result of the interaction effect of class size and teacher in-service training.

CHAPTER II

PROCEDURES AND METHODOLOGY

Introduction

The purpose of this chapter is to discuss the procedures and methodology used in the implementation of the project design. The chapter is divided into four major sections. The first section, entitled "Procedures", gives a brief summary of the procedures used to coordinate the project and a general outline of the time schedule for project activities. The second section, entitled "Sample Selection and Assignment", presents the procedures used in selecting the student sample and in assigning the students to the two treatment groups, large class size and small class size. In the third section, entitled "Definitions of Variables", the variable definitions and data collection procedures are discussed. The research design of the project is provided in the fourth section, entitled "Research Design of the Project".

Procedures

The Office of General Education and the Office of Research were jointly responsible for the administration and coordination of this project. The Office of General Education was primarily responsible for allocating the project funds and conducting the in-service workshops; while the Office of Research was primarily responsible for developing the research design, coordinating the pretesting and posttesting, analyzing the data, and documenting the project results.

Within each of the participating districts, a person was appointed by the district superintendent to serve as the district project coordinator. The project coordinators were responsible for communicating the project activities to the project teachers, coordinating the pretesting and posttesting within each district, and distributing the score reports to the project teachers.

In July of 1975, a letter and a questionnaire were sent to the district superintendents of each of the State's 92 public school districts for the purpose of delineating the criteria that had to be met in order for a district to be eligible to participate in the project. Interested superintendents were requested to send a representative to Columbia, South Carolina, in August, 1975, to clarify questions regarding criteria for participation and to discuss those aspects of the project design which directly involved the districts. Those aspects which were discussed at the meeting are presented in the document entitled "Procedures and Impact", which is included in Appendix A of this report.

In September of 1975, the Office of Research conducted three regional workshops to train project teachers in standardized testing procedures to be followed in administering the pretest and posttest. The Office of Research recommended that the pretest be administered to all project students on September 23, 24, and 25, 1975. Districts which had conflicting school activities that prevented the administration of the test on the recommended dates administered the test on the same days of the following week.

In the interval between the pretesting and posttesting, the Office of General Education conducted eight in-service workshops for teachers

in selected districts. The dates of these workshops were: September 25, 1975; October 23, 1975; November 18, 1975; January 8, 1976; February 11, 1976; March 25, 1976; April 8, 1976; and April 25, 1976.

In March of 1976, the "First Grade Project Questionnaire" was sent to all project teachers in order to collect data on several variables, such as student Title I classification (see Appendix B of this report for a copy of the questionnaire). During April, data were precoded on the posttest booklets by clerical personnel to insure consistency and accuracy in coding. The recommended dates for the posttesting were May 3, 4, and 5, 1976. A recommendation similar to the one made for the pretesting was made to districts with conflicting activities.

The California Test Bureau (CTB) was responsible for the scoring of both the pretest and posttest booklets. The Office of Research was responsible for collecting the booklets, shipping the booklets to CTB, and distributing the score reports to the district project coordinators.

Sample Selection and Assignment

The selection and assignment of the first graders who participated in the project were accomplished by utilizing a three stage procedure. In the first stage, project districts were selected from those districts that met the criteria for participation as defined by the State Department of Education. After the districts were selected, each of the districts was responsible for selecting the project school(s) within the district. In the third stage, random selection and assignment

procedures were used within each of the project schools to select project students and assign the students to one of the two treatment groups. A class of approximately 29 students, referred to as the large ("normal" or control) class, constituted one treatment group; and a class of approximately 21 students, referred to as the small ("reduced" or experimental) class, constituted the other treatment group.

Selection of Districts

In order for a district to be eligible to participate in the project, a district was required to meet the following criteria, specified by the State Department of Education:

1. The district had one school building having an enrollment of at least 50 first grade students.
2. Space for an additional classroom was available in that building.
3. The district could guarantee participation in an evaluation investigating the effectiveness of instructional approaches with smaller first grade classes.
4. The district had local funds available for:
   a. renovating and/or equipping the classroom.
   b. supplementing an additional teaching position funded to each project district from the monies allocated by the Legislature.

Thirty-three of the State's 92 public school districts were able to meet these criteria.

In order to determine the final district sample, these districts were compared on the following characteristics:

1. number of buildings containing 50 or more first graders;
2. number of buildings with space available for one or more additional classrooms;

3. number of classrooms for which necessary local funds were available;
4. number of buildings with experimental programs or research activities;
5. number of buildings that included team teaching;
6. number of buildings with ungraded programs;
7. number of first grade students based on 1973-74 180-day enrollment and fall 1975 enrollment data;
8. number of white first graders and number of nonwhite first graders based on 1973-74 180-day enrollment and fall 1975 enrollment data; and
9. geographic location.

As a result of the comparison of the 33 districts on the preceding characteristics, twenty-five districts were selected as the sample. These 25 districts met the requirements of the project design and were representative of South Carolina school districts in terms of district enrollment and geographic location. The selection of the districts was necessarily nonrandom because of the limitations placed on district participation by the project design.

Selection of Schools

The second stage of the sampling and assignment procedure involved the selection of schools within each of the 25 districts that had been selected to participate in the study. District personnel in each of the selected districts were responsible for selecting a school that met the following two criteria:

1. The school had a first grade enrollment of at least 50 first grade students.
2. The school had additional classroom space available in the building to accommodate two project classes, that is, a class with a "normal" class size and a class with a "reduced" class size.

After identifying the schools in the district that met these two criteria, the district personnel made the final selection of the project school. As mentioned previously, an additional first grade teaching position was funded in each of the project districts.

In an attempt to insure representativeness of the sample, the decision was made to have two pairs of project classes in two of the State's largest districts.

The two project classes in three districts could not be based within the same school building because of situational factors. In these three cases the schools selected were to be matched at least on the racial composition of the students, the socioeconomic background of the students, and the type of school curriculum.

Since the selection of schools was governed by the project design and practical limitations, the procedure for school selection was also nonrandom. However, since district personnel were instructed to select schools that were typical of the majority of elementary schools in that district, the assumption was made that the schools selected represented a cross section of South Carolina's elementary schools.

Selection and Assignment of Students

The third stage of the sampling procedure involved the selection of the project students and the assignment of these students to one of two treatment groups. The following random selection and assignment procedure was followed by district personnel in determining the student sample:

1. Place each first grader's name on a small slip of paper. Include ALL non-special education first graders in the school building.
2. Place all of the slips of paper containing the names of students into a container (waste basket, hat, etc.).
3. Have a small child draw 21 slips from the container. Shake the container before each drawing. The children whose names are on the first 21 slips shall be assigned to the experimental class.
4. In the same manner, select 29 more slips. These 29 designated children shall be assigned to the control class.
5. Assign the remaining first graders to other classes as is normally done in the school.

Using a similar procedure, district personnel randomly selected two teachers from all first grade teachers that were currently on the school's faculty. Each project teacher was then randomly assigned to one of the two project classes in the school. The target class sizes of 21 and 29 were determined through the examination of the first grade class enrollments reported by teachers to the Department's 1974-75 Basic Educational Data System.

If local conditions were such that the class sizes of 21 and 29 were not feasible, districts were instructed to determine the class sizes on the basis of the district's first grade enrollment. In these cases, the average first grade class size was determined on the basis of district enrollment data. The experimental class size was established at 23% less than the district's average first grade class size. The control class size was established by adding a number of students to the experimental class size that would insure an average daily attendance that was approximately equal to the district's average first grade class size.

In many instances, laws governing federally supported educational programs prevented districts from adhering to the requirements of the recommended sampling procedure. Consequently, several sampling procedures were used. Several districts attempted a proportional random sample stratified by one or more of the following variables: race, sex, and student ability. Thus, the project classes were matched on sampling procedure within districts; however, the project classes were not matched on sampling procedure across districts. Districts that deviated from the recommended procedure were required to submit documentation of the procedure used to the Office of Research.

Sample Description

The South Carolina First Grade Pilot Project sample initially consisted of 25 districts, 30 project schools, and 54 project classes. Student lists provided by the districts prior to the pretesting indicated that the student sample originally consisted of 1273 students; however, lists received prior to the posttesting indicated that the sample size had dropped to 1245 students.

Because of problems in the project data, two districts were eliminated from the analysis (see the Edit of the Data Section of Chapter III for an explanation). Therefore, the final project sample consisted of 23 districts, 28 project schools, and 50 project classes. Since the two largest districts in the project each contained four project classes, for analysis purposes, these two districts were considered as four districts. That is,

each of the two districts contained one set of project classes that was artificially contrived as a separate district. Therefore, although in actuality there were 23 districts in the final project sample, the analysis portion of the project reflects the two artificial districts; and the number of districts appears to be 25 rather than 23.

Table 1 on the following page reveals the number of first grade students in each of the two project classes within each of the 25 class pairs. The mean class size of the large or control classes was 26.7 students, and the mean class size of the small or experimental classes was 19.9 students. The mean class size difference was 6.8 students. The class size differences revealed that there was a difference of at least four students between classes in a given pair.

Data describing the first grade student sample in terms of kindergarten experience and Title I classification are presented in the Examination of Extraneous Variables Section of Chapter III.

Table 1

Difference between the Control Class Size (C) and the Experimental Class Size (E) for Each of the 25 Pairs of Project Classes

Class Pair	Control Class Size (C)	Experimental Class Size (E)	Difference (C-E)
1	24	17	7
2	26	19	7
3	24	19	5
4	27	20	7
5	27	21	6
6	30	23	7
7	24	20	4
8	32	24	8
9	26	21	5
10	27	21	6
11	28	21	7
12	28	20	8
13	27	20	7
14	29	21	8
15	26	20	6
16	29	21	8
17	24	18	6
18	24	17	7
19	25	18	7
20	25	19	6
21	29	20	9
22	28	21	7
23	27	19	8
24	27	20	7
25	25	18	7
M	26.7	19.9	6.8

Definitions of Variables

For the purpose of evaluating the programmatic effects, data were collected on 13 variables: two independent variables, four dependent variables, one classification variable, two covariates, and four extraneous variables. The two independent variables were class size and teacher in-service training. The four dependent variables were posttest reading achievement, posttest mathematics achievement, posttest language achievement, and overall posttest achievement. The classification variable was school district. The two covariates were prior reading achievement and prior mathematics achievement. The four extraneous variables were teacher race, utilization of teacher aides, student Title I classification, and student kindergarten experience.

All student-related variables except posttest reading achievement and posttest mathematics achievement were coded on the posttest booklets. The teacher-related variables were coded on the group data forms (CTB Group Information Sheets) that accompanied the posttest booklets for each project class in the scoring shipment. CTB placed the variable data on a research tape that was used by statistical analysts in the Office of Research in performing the data analysis.

For purposes of quality control, after both the pretest and posttest administrations, the Office of Research had all project test booklets shipped to the State Department of Education. Trained clerical staff coded the Group Information Sheets and edited the test booklets. Whenever possible, data coded incorrectly on the test

booklet covers were corrected. Student responses marked in the test booklets were edited for extraneous marks, multiple gridding, and patterned responses. Those test booklets that did not meet Office of Research standards were eliminated from the scoring shipment and, consequently, eliminated from the analysis. Since the majority of variable data had to be coded on the posttest booklets, an additional quality control measure was taken prior to the posttest administration. Clerical staff coded all variable data on the posttest materials in order to insure consistency and accuracy in coding.

The definitions for each of the 13 variables are given in the following sections.

Independent Variables

The independent variables in an experimental study are those variables that are manipulated, or changed, by the experimenter in order to observe the effects of these variables on the outcome of the study. The effects of two independent variables, class size and teacher in-service training, were investigated in this study.

Class size referred to the number of students for which each project teacher was daily responsible. This variable had two levels: a small class size ("reduced" or experimental class), and a large class size ("normal" or control class). The assignment of students to these two treatment groups has been described in the Student Selection and Assignment Section of this chapter.

In order to measure the effects of in-service training, the Office of Research randomly selected and assigned each project district to one of two treatment groups, an in-service group or a no in-service group. In other words, if a district was selected to be in the in-service group, the two project teachers in that district received in-service training; if a district was selected to be in the no in-service group, the two project teachers in that district did not receive in-service training. The Office of General Education conducted a total of eight in-service training sessions during the time between the pretesting and posttesting. (A synopsis of the content of each in-service session is given in Appendix C of this report.)

Dependent Variables

The dependent variables in an experimental study are those variables upon which the effects of manipulating the independent variables are observed. In other words, the dependent variables represent the phenomena that are being investigated. The two dependent variables that were of primary concern in this study were posttest reading achievement and posttest mathematics achievement. Two other dependent variables that were also investigated were posttest language achievement and posttest overall achievement. The Comprehensive Tests of Basic Skills, Form S (CTBS/S), Level B, which was administered in May, 1976, was used to measure these four variables.

The posttest reading achievement of each student was defined as the total scale score obtained by the student on the Reading Test of the CTBS/S, Level B. The Reading Test consisted of the following subtests: Letter Sounds, Word Recognition I, Word Recognition II, and

Reading Comprehension.

The posttest mathematics achievement of each student was defined as the total scale score obtained by the student on the Mathematics Test of the CTBS/S, Level B. The Mathematics Test consisted of the following two subtests: Mathematics Concepts and Applications and Mathematics Computation.

The posttest language achievement of each student was defined as the total scale score obtained by the student on the Language Test of the CTBS/S, Level B. The Language Test consisted of the following two subtests: Language I and Language II.

The posttest overall achievement was defined as the total battery scale score which is a composite score derived from the Reading Test, Mathematics Test, and Language Test of the CTBS/S, Level B.

Classification Variable

Only one classification variable, school district, was used to investigate the project data. "School district" referred to a pair of project classes, an experimental class and a control class, usually within the same school. In three districts the project classes were located in separate schools. In the case of the two largest districts, which each contained two project schools with a pair of project classes within each school, each of the two schools constituted one school district.

Covariate

Covariates are used in a statistical analysis of covariance to adjust the dependent variable measures with respect to some

characteristic. In this study, prior reading and mathematics achievement as measured by the pretest were used to adjust for initial differences in student achievement for both the experimental and control classes. The Comprehensive Tests of Basic Skills, Form S (CTBS/S), Level A, which was administered in September, 1975, was used to measure prior achievement. The prior reading achievement of each student was defined as the total scale score obtained by the student on the Reading Test of the CTBS/S, Level A. The Reading Test consisted of the following subtests: Letter Forms, Letter Names, Listening for Information, Letter Sounds, Visual Discrimination, Sound Matching, and Language. The prior mathematics achievement of each student was defined as the total scale score obtained by the student on the Mathematics Test of the CTBS/S, Level A. The Mathematics Test was not divided into subtests.

Extraneous Variables

Variables that are unrelated to the purpose of the study but which could have confounding effects on the outcome of the study as measured by the dependent variable are called extraneous variables. Data were available to measure four such variables: teacher race, utilization of teacher aides, student Title I classification, and student kindergarten experience.

The race of each teacher was obtained from the Department's 1974-75 Basic Educational Data System. The two levels of this variable were white and nonwhite.

"Utilization of teacher aides" referred to whether or not a project teacher received assistance from a teacher's aide. The

procedures set forth in the "Procedures and Impact" document required consistency within a district with respect to utilization of teacher aides (see Appendix A). No statement concerning which persons qualified as teacher aides was made in the "Procedures and Impact" document. Furthermore, no information on the type of work performed by the teacher aides was collected. The collection of these two pieces of information would have increased the accuracy in assessing the effects of this variable on the dependent variables.

"Student Title I classification" referred to whether or not a student was classified as Title I under the 1974-75 revision of the Elementary and Secondary Education Act (ESEA) of Public Law 89-10. Students were classified as either Title I or non-Title I.

"Student kindergarten experience" referred to whether a student was classified as either having kindergarten experience or as not having kindergarten experience. A student was regarded as having kindergarten experience if he or she had participated in a planned educational program, whether public or private, below the first grade level. Day care centers, nursery schools, church schools, and other institutions, whose activities were not planned or designed as educational, did not constitute kindergarten experience.

Information on teacher aide, student Title I classification, and student kindergarten experience was collected via the "First Grade Project Questionnaire" (see Appendix B).

Research Design of the Project

The South Carolina First Grade Pilot Project 1975-76 was an experimental project designed to investigate the individual effects of

class size and teacher in-service training, as well as the combined effects of these two variables on the achievement of first grade students. The independent variables were class size and teacher in-service training; the two dependent variables of primary concern were end-of-the-year reading and mathematics achievement. This project was experimental in nature since the independent variables, which constitute the treatments, were manipulated by the researchers in order to observe the effects of the independent variables on the dependent variables. On the other hand, a classification variable such as race does not constitute a treatment since the variable represents a characteristic which exists prior to the experiment and cannot be manipulated by the researchers.

For the purpose of investigating the effects of the independent variables on the dependent variables, a pretest-posttest control group design was implemented. The first grade students within a given district were randomly selected and randomly assigned to one of two treatment groups: (1) the experimental class which consisted of an average of 19.9 students or (2) the control class which consisted of an average of 26.7 students. The pretest, which was administered in September, 1975, was used to account for initial differences in the prior achievement of the experimental and control classes. The posttest, which was administered in May, 1976, was used to measure end-of-the-year achievement.

CHAPTER III

RESULTS

Introduction

The results from the project data were obtained by means of a three-stage analysis procedure. This procedure consisted of: (1) an edit of the data; (2) an examination of the extraneous variables; and (3) tests of significant differences among the treatment groups. (Refer to Appendix D for the definitions of symbols used in the tables of the results.)

Edit of the Data

The first stage, edit of the data, involved the elimination of the project schools in which the experimental data were obviously invalid. Once these schools were eliminated, the students whose reported scores exceeded the limits of the test score distribution were eliminated from the project data. Finally, the data for the remaining schools were checked and corrected for improper coding.

Data for two school districts had to be eliminated from the project data. In one district, the posttest data for the control class were unrealistically high. In the other district, the control class had a high teacher turnover; and, as a consequence, the posttest data did not represent measures of achievement in a "normal" situation. Since the project design was based on a pairing of experimental and control classes, data for the experimental class in each of these two districts were also eliminated from subsequent analyses. Consequently, the data set for the analyses was reduced from 54 observations

(54 project classes) to 50 observations (50 project classes).

Based upon the scaling procedure used by the test publisher, a review of the students' pretest and posttest scores revealed that some of the scores reported were unrealistically high or low. Scores for these students were deleted from the data set, and the class means were computed without these extreme scores.

Finally, the remaining data were examined for obvious errors in coding, such as improper coding of the school identification numbers and the teacher aide variable. The errors discovered were corrected to correspond with reliable documentation available in the Office of Research.

The editing procedure allowed for improving the data to the fullest extent possible. Tables 2, 3, 4, and 5 on the following pages reveal the effects of the various editing steps on the project data set.

Examination of Extraneous Variables

The second stage of the analysis procedure involved examining extraneous variables to determine if their differences among treatment groups were substantial enough to cast doubt on the experimental results. Since variation in achievement as a consequence of variation in class size was the primary focus of this project, those variables that could have influenced the class mean posttest achievement results were studied. The effects of the following extraneous variables were analyzed by the class size variable: student Title I classification,

Table 2

Valid Standard Score Limits
Used for Editing Achievement Measures

Variable	Valid Scale Score Lower Limit	Valid Scale Score Upper Limit
Pretest Reading Achievement[a]	8	290
Pretest Mathematics Achievement[a]	109	284
Posttest Reading Achievement[b]	29	346
Posttest Language Achievement[b]	44	398
Posttest Mathematics Achievement[b]	111	350
Posttest Overall Achievement[b]	19	370

[a]CTBS, Level A, Form S, administered September, 1975.

[b]CTBS, Level B, Form S, administered May, 1976.

Table 3

Report of "Missing" and "Missing and Edited" Measures for the Study

Variable	"Missing" Measures			"Missing and Edited" Measures		
	Experimental Frequency	Control Frequency	Total Percent	Experimental Frequency	Control Frequency	Total Percent
Student Title I Classification	1	7	0.7	not edited		
Student Kindergarten Experience	1	4	0.4	not edited		
Pretest Reading Achievement	8	23	2.6	12	33	3.7
Pretest Mathematics Achievement	12	21	2.7	12	24	3.0
Posttest Reading Achievement	9	12	1.7	9	12	1.7
Posttest Language Achievement	6	5	0.9	6	5	0.9
Posttest Mathematics Achievement	9	9	1.5	9	9	1.5
Posttest Overall Achievement	15	19	2.8	15	19	2.8

Table 4

Total Frequency of Individual "Missing"
Pretest and Posttest Achievement Measures by Treatment

Lost Achievement Measures per Observation[a]	Experimental Group Frequency	Control Group Frequency	Total Percent
1	4	5	0.7
2	16	31	3.9
3	3	4	0.6
4	2	1	0.2
5	0	1	0.1
6	1	0	0.1
Total	26	42	4.8

[a]Each project class constituted one observation.

Table 5

Total Frequency of Individual "Missing and Edited" Pretest and Posttest Achievement Measures by Treatment

Lost Achievement Measures per Observation[a]	Experimental Group Frequency	Control Group Frequency	Total Percent
1	2	16	1.5
2	19	31	4.1
3	3	5	0.7
4	2	1	0.2
5	0	1	0.1
6	1	0	0.1
Total	27	54	6.7

[a]Each project class constituted one observation.

student kindergarten experience, teacher race, and teacher aide. If any one of these variables was present in one class size category to a greater degree than in the other class size category, the difference observed in student posttest achievement could have been attributable to an imbalance in the extraneous variable rather than the class size variable.

Table 6 reports the percentage of first grade Title I students in small classes and in large classes. In the small classes, an average of 33.3% of the students were enrolled in Title I programs; in the large classes, an average of 32.7% were enrolled in Title I programs. The mean percentages of the two treatment groups differed by only 0.6%. Although not tabled, the greatest difference in any one pair of classes was 44.7%. In this class pair, the small class contained a higher proportion of Title I students than the large class. At the other extreme, the large class contained 25% more Title I students than the small class. These two extremes tended to cancel each other out. The comparisons between the small classes and the large classes indicated that the group of small classes and the group of large classes were equivalent with respect to the relative participation of students in Title I programs.

Table 7 reports the percentages of first grade students in each class size category who had attended kindergarten prior to the first grade. In the small classes, an average of 68% of the first graders had kindergarten experience; whereas, in the large classes an average of 73.6% of the first graders had kindergarten experience. In the class pair with the greatest difference on this variable,

Table 6

Percentage of Title I Students by Class Size Category

Class Size Category	Percentage		
	M	Minimum	Maximum
Small Classes	33.3	0.0	100.0
Large Classes	32.7	0.0	100.0
Difference	0.6		

Table 7

Percentage of Students Having Kindergarten Experience by Class Size Category

Class Size Category	Percentage		
	M	Minimum	Maximum
Small Classes	68.0	15.8	100.00
Large Classes	73.6	20.0	100.00
Difference	-5.6		

twenty-five percent more of the students in the small class had attended kindergarten. At the other extreme, the large class contained 17.5% more students with kindergarten experience than the small class. The absolute difference between the mean percentages of the two class size categories was 5.6%. As a consequence of these statistics, the assertion that the two class size categories were substantially equivalent on the kindergarten variable seemed questionable. Under the assumption that kindergarten experience tends to increase school achievement, the slight bias in the distribution of kindergarten experience would favor the large class size group.

Table 8 reports both frequencies and percentages of teacher race categorized by class size. The percentages of white teachers in the small and large classes were 76% and 72%, respectively. The percentages of nonwhite teachers in the small and large classes were 24% and 28%, respectively. Therefore, the data for teacher race support the contention that the two class size categories were substantially equivalent in terms of teacher race.

Table 9 provides by class size category the extent to which teacher aides were available to teachers in project classes. With one exception, the project classes in each of the class pairs all reported identical values on the teacher aide variable for both the large and the small classes. In the single exception, the small class had a teacher aide four to five days per week; while the large class had a teacher aide two to three days per week. Consequently, classes in the two size categories were substantially equivalent in the extent to which teacher aides were available. For subsequent analyses, the four

Table 8

Teacher Racial Distribution in Large and Small Classes by Class Size Category

Class Size Category	White		Nonwhite		Total	
	Frequency	%	Frequency	%	Frequency	%
Small Classes	19	76	6	24	25	100
Large Classes	18	72	7	28	25	100
	37[a]	74[b]	13[a]	26[b]	50[a]	100[b]

[a] n = total number for each category.

[b] mean percentage for each category.

Table 9

Distribution of Teacher Aide by Class Size Category

Class Size Category	Frequency			
	0 day/week	1 day/week or less	2-3 day/week	4-5 day/week
Small Classes	11	3	1	10
Large Classes	11	3	2	9
Total	22	6	3	19

categories for the teacher aide variable were collapsed into two categories: one indicated total absence of teacher aide assistance, while the other category indicated the presence of teacher aide assistance. For this dichotomization of the teacher aide variable, large and small classes within a given pair were matched perfectly. As indicated in the table, forty-four percent of the classes (22 classes of which eleven were small and eleven were large) received no assistance from a teacher aide; while fifty-six percent (28 classes of which fourteen were large and fourteen were small) received assistance from a teacher aide for periods of time ranging from less than one day per week to five days per week. Thus, the two class size groups were substantially equivalent with respect to teacher aides.

As a final check on equivalence between the two class size categories, pretest measures of achievement were analyzed. The pretest measures were class mean expanded scale scores on the reading and mathematics subtests of the Comprehensive Tests of Basic Skills, Form S, Level A. Tables 10 and 11 report results of these analyses by the two class size categories. The two class size groups differed very slightly on the pretest measures of reading and mathematics achievement. Neither the difference of 4.5 scale score units for reading nor the difference of 1.2 scale score units for mathematics was statistically significant. These findings support the contention that the two class size categories were substantially equivalent on the pretest measures of reading and mathematics achievement.

Of interest was the finding that the greatest absolute difference between classes in a pair favored the large class for both reading and

Table 10

Pretest Class Means for Reading Achievement by Class Size Category

Class Size Category	Lowest Measure	Highest Measure	M	Range
Small Classes	153.0	225.2	180.7	72.2
Large Classes	146.5	236.0	185.2	89.5
Difference			-4.5	-17.3

Table 11

Pretest Class Means for Mathematics Achievement by Class Size Category

Class Size Category	Lowest Measure	Highest Measure	M	Range
Small Classes	190.1	231.1	206.7	41.0
Large Classes	187.1	240.0	207.9	52.8
Difference			-1.2	-11.8

mathematics. For this pair the difference in reading was 32.4 scale score units, and the difference in mathematics was 29.4 scale score units. The greatest differences favoring the small class were 26.8 scale score units in reading and 27.1 scale score units in mathematics. However, the differences favoring the small class tended to counteract the differences favoring the large class.

In summary, the two class size groups were substantially equivalent on all extraneous and control variables except for a slight bias favoring the large classes in terms of percentage of first grade students having kindergarten experience.

Tests of Significant Differences

The six hypotheses of the study were tested using a three-factor analysis of covariance to determine if there were significant differences among treatment groups. Two of the three factors were the independent variables, class size and teacher in-service training, each of which consisted of two levels. The third factor was the categorical factor, school district, which consisted of 25 levels. Each of the 25 school districts that were retained for the final analyses contained two classes. The pretest measures for reading and mathematics served as the covariates. These covariates were used to adjust the posttest measures of reading and mathematics for initial differences in student achievement. Both the pretest and posttest measures of reading and mathematics achievement were class means and not individual student scores.

Findings Related to Hypotheses Using Posttest Reading Achievement as the Dependent Variable

Three hypotheses were tested using pretest reading achievement as the covariate and posttest reading achievement as the dependent variable. The results for each of these three hypotheses follow.

Hypothesis I: There will be no difference in the reading achievement of first grade students in small classes and first grade students in large classes.

The adjusted means for the posttest reading scores of the two class size groups are presented in Table 12.

Table 12

Adjusted Means (M) of Class Posttest Mean Reading Scale Scores for the Large and Small Class Sizes

Class Size[a]	M
Large	255.7
Small	268.9

[a] n = 25.

The results from the analysis of covariance indicated that the mean posttest reading achievement for the small class size group was significantly higher than the mean for the large class size group, $F_{(1,22)} = 18.54$, $p < .0003$ (see Table 15).

Hypothesis II: There will be no difference in the reading achievement of first grade students whose teachers received in-service training and first grade students whose teachers did not receive in-service training.

The adjusted means for the posttest reading scores of the two in-service groups are presented in Table 13.

Table 13

Adjusted Means (M) of Class Posttest Mean Reading Scale Scores for the In-service and No In-service Groups

In-service Groups	M
In-service training[a]	264.1
No in-service training[b]	260.5

[a] $n = 24$.

[b] $n = 26$.

The results from the analysis of covariance indicated that the mean posttest reading achievement for the group of students whose teachers received in-service training was slightly higher than the mean posttest reading achievement for the group of students whose teachers did not receive in-service training. The difference in achievement between these two treatment groups, however, was not statistically significant, $F_{(1,23)} = .12$, $p > .7322$ (see Table 15).

Hypothesis III: There will be no difference in the reading achievement as a result of the interaction effect of class size and teacher in-service training.

The adjusted means for the posttest reading scores for the class size by in-service interaction groups are presented in Table 14.

Table 14

Adjusted Means (M) of Class Posttest Mean Reading Scale Score for the Class Size In-service Interaction Groups

Interaction Groups	M
Large with in-service[a]	261.3
Small with in-service[a]	267.0
Large without in-service[b]	250.5
Small without in-service[b]	270.6

[a] $n = 12$.

[b] $n = 13$.

The results from the analysis of covariance indicated that the interaction effect of class size and in-service training was statistically significant, $F_{(1,22)} = 4.57$, $p < .0439$ (see Table 15). A weak interaction seemed to be operating to produce differential reading achievement among the four treatment groups. Tukey's "honestly significant difference" test at the .05 level of significance revealed that there were three homogeneous subsets among the means for the following four groups: large classes without in-service training were significantly different from

Table 15

Analysis of Covariance Summary Table for the Class Means of CTBS/S, Level B, Total Reading Subscale

Source	df[a]	SS[b]	MS	F
In-service	1	62.22	62.22	0.12
District (In-service)	23	11624.00	505.40	
Class Size	1	2504.02	2504.02	18.54**
In-service X Class Size	1	617.02	617.02	4.57*
Class Size X District (In-service)	22	2971.75	135.08	

[a]The covariate prereading accounted for 1 df and substantially reduced the error variance in the dependent variable.

[b]Sums of squares are partitioned sequentially in the order indicated in the table.

*$p < .05$.

**$p < .0003$.

the other groups; the two groups receiving in-service training formed a second subset; and the two groups of small classes formed a third.

The results of the analysis of covariance for the dependent variable reading achievement are summarized in Table 15. Since significant F values were obtained for Hypothesis I and Hypothesis III, these two hypotheses were rejected; however, a significant F value was not obtained for Hypothesis II, and this hypothesis was not rejected.

Findings Related to Hypotheses Using Posttest Mathematics Achievement as the Dependent Variable

Three hypotheses were tested using pretest mathematics achievement as the covariate and posttest mathematics achievement as the dependent variable. The results for each of these three hypotheses follow.

Hypothesis IV: There will be no difference in the mathematics achievement of first grade students in small classes and first grade students in large classes.

The adjusted means for the posttest mathematics scores for the two class size groups are presented in Table 16.

Table 16

Adjusted Means (M) of Class Posttest Mean Mathematics Scale Scores for Large and Small Class Size

Class Size[a]	M
Large	209.2
Small	221.4

[a] n = 25.

The results from the analysis of covariance indicated that the mean posttest mathematics achievement for the students in small classes was not significantly different from the mathematics achievement of those students in large classes, $F_{(1,22)} = 4.03$, $p > .0571$ (see Table 19).

Hypothesis V: There will be no difference in the mathematics achievement of first grade students whose teachers received in-service training and first grade students whose teachers did not receive in-service training.

The adjusted means for the posttest mathematics scores for the two in-service groups are presented in Table 17.

Table 17

Adjusted Means (M) of Class Posttest Mean Mathematics Scale Scores for the In-service and No In-service Groups

In-service Training	M
In-service[a]	216.21
No In-service[b]	214.44

[a] $n = 24$.

[b] $n = 26$.

The results from the analysis of covariance indicated that the mean posttest mathematics achievement for the students whose teachers received in-service training was not significantly different from the mathematics achievement of those students whose teachers did not, $F_{(1,23)} = 0.33$, $p > .5712$ (see Table 19).

Hypothesis VI: There will be no difference in the mathematics achievement as a result of the interaction effect of class size and teacher in-service training.

The adjusted means for the mathematics achievement scores for the class size by in-service interaction groups are presented in Table 18.

Table 18

Adjusted Means (M) of the Class Posttest Mean Mathematics Scale Scores for the Class Size and In-service Interaction Groups

Interaction Groups	M
Large with In-service[a]	214.75
Small with In-service[a]	217.67
Large without In-service[b]	204.13
Small without In-service[b]	224.75

[a] $n = 12$.

[b] $n = 13$.

The results from the analysis of covariance indicated that the interaction effect of class size and in-service training was not statistically significant, $F_{(1,22)} = 2.02$, $p > .1693$ (see Table 19).

The results of the analysis of covariance for the dependent variable mathematics achievement as measured by mean class total mathematics scale scores on the CTBS/S, Level B, are summarized in Table 19. Since no significant F values were obtained, Hypothesis IV, Hypothesis V, and Hypothesis VI could not be rejected.

Table 19

Analysis of Covariance Summary Table for the Class Means of CTBS/S, Level B, Total Mathematics Subscale

Source	df[a]	SS[b]	MS	F
In-service	1	64.93	64.93	0.33
District (In-service)	23	4526.83	197.25	
Class Size	1	823.66	823.66	4.03
In-service X Class Size	1	413.35	413.35	2.02
Class Size X District (In-service)	22	4498.23	204.47	

[a]The covariate premath accounted for 1 df and substantially reduced the error variance in the dependent variable.

[b]Sums of squares are partitioned sequentially in the order indicated in the table.

*$p < .05$.

Additional Findings

Since posttest measures on language and overall achievement were available, hypotheses similar to the six preceding research hypotheses were tested for significance in these two dependent variables. Language achievement was defined as the class mean scale score on the language subtest of the CTBS/S, Level B; overall achievement was defined as the class mean total battery scale score on the CTBS/S, Level B. The total battery score is a composite measure of reading, mathematics, and language achievement. The results of the analysis of covariance are summarized briefly below.

An analysis of covariance was performed using pretest reading achievement as the covariate and language achievement as the dependent variable. The analysis indicated that none of the following variables had a significant effect on the language achievement of first graders: class size, in-service training, and the interaction of class size and in-service training.

An analysis of covariance was also performed using pretest reading and pretest mathematics as the covariates and overall achievement as the dependent variable. The analysis indicated that only class size had a significant effect on the overall achievement of first graders, $F_{(1,22)} = 13.66$, $p < .0013$. The adjusted total battery scale score means were 209.2 and 221.4 for large classes and small classes, respectively. In-service training did not have a significant effect on the overall achievement of first graders, $F_{(1,22)} = 0.37$, $p > 0.5488$. Additionally, the interaction of class size and in-service training did not have a significant effect on the overall achievement of first graders, $F_{(1,22)} = 2.07$, $p > 0.1636$.

CHAPTER IV

SUMMARY OF THE RESULTS, COST EFFECTIVENESS, AND IMPLICATIONS

Introduction

The first section of this chapter is a summary of the results for each of the six hypotheses. Also presented in this chapter are discussions of the results in terms of cost effectiveness and implications.

Summary of the Results

A summary of the results with respect to each of the six hypotheses follows:

Hypothesis I: The reading achievement of first graders in small classes was significantly higher than the reading achievement of first graders in large classes. Although the increase in achievement was slight, the increase was sufficient to be considered a "real" increase rather than a "chance" increase. The results for this hypothesis lend support to the findings of past research in which students in smaller classes obtained higher achievement in reading than students in larger classes (Balow, 1969; Furno & Collins, 1967).

Hypothesis II: The reading achievement of students whose teachers did receive in-service training was not significantly different from the reading achievement of students whose teachers did not receive in-service training. Therefore, there was no evidence that teacher in-service training affected the reading achievement of the first graders.

Hypothesis III: The reading achievement of students in large classes with teacher in-service training, small classes with teacher in-service training, and small classes without teacher in-service training was higher than the reading achievement of students in large classes without teacher in-service training. Furthermore, the difference in reading achievement between the large classes without in-service group and each of the other three groups was substantial enough to be considered a "real" difference rather than a "chance" difference.

Hypothesis IV: The mathematics achievement of first grade students in small classes was not significantly different from the mathematics achievement of first grade students in large classes. The results indicated that reducing class size did not have an effect on mathematics achievement of first grade students. The results from this hypothesis tend to support the previous research which contends that class size does not affect mathematics achievement (Taylor & Fleming, 1972).

Hypothesis V: The mathematics achievement of first grade students whose teachers did receive in-service training was not significantly different from the achievement of first grade students whose teachers did not receive in-service training. Therefore, the results indicated that teacher in-service training did not have an effect on mathematics achievement of first grade students.

Hypothesis VI: The findings for this hypothesis indicated that there were no significant differences in first grade mathematics achievement among the four treatment groups - small classes with

teacher in-service training, small classes without teacher in-service training, large classes with teacher in-service training, and large classes without teacher in-service training. Consequently, the interaction of class size and teacher in-service training did not appear to affect the mathematics achievement of first grade students.

Additional Findings: Additional questions concerning the effects of class size, teacher in-service training, and the interaction of class size and teacher in-service training on language and overall achievement were explored.

The results from the language achievement analyses indicated that class size, teacher in-service training, and the interaction of class size and teacher in-service training did not significantly affect the language achievement of first grade students.

The results from the overall achievement analyses indicated that the overall achievement of first grade students in small classes was significantly greater than the overall achievement of first grade students in large classes. However, neither teacher in-service training nor the interaction of class size and teacher in-service training had any significant effects on overall achievement.

Cost Effectiveness of Reducing Class Size

The results of the project indicated that the reading achievement of first grade students in small classes was significantly higher than the reading achievement of first grade students in large classes. Given the significance of this finding, the question of essence seemed to be, "Is this increase in reading achievement worth the investment

of additional funds to reduce class size?". The cost effectiveness analysis of the project reading results reflected the increase in reading achievement as a result of the reduction in class size, the cost of reducing class size, and the increase in reading achievement per unit cost of reducing class size.

The reduction of class size necessarily demands increased allocations of public school funds. Although many operational expenditures, such as instructional and library supplies and administrative staff, would not exceed the current budget on a per-pupil basis, the reduction in class size would require additional funds for classroom facilities and teachers. Although enrollment in kindergarten programs has increased over the past several years, this increase has not been sufficient to compensate for the lack of utilization of those classrooms left vacant as a result of the decrease in births within the State. Thus, the cost of new classrooms, together with increased maintenance, heating, air-conditioning, and lighting expenses, were eliminated from the cost considerations in this report; and only increased costs for teachers were considered in the cost effectiveness analysis.

The first stage of the cost effectiveness analysis involved determining the expected increase in reading achievement of first grade students without the experimental intervention and without exceeding the present educational budget. In order to determine the expected increase in reading achievement without experimental intervention, a stepwise regression procedure was utilized. Implicit within the stepwise regression procedure were the assumptions of a

linear model. Student Title I classification, prior kindergarten experience, student age in months, and teacher in-service training were regressed upon the individual student reading achievement measures on the pretest. To avoid violation of the assumptions of the linear model, first grade students who might have been repeaters were deleted from the analysis by removing those first graders whose chronological age exceeded 89 months (7 years and 5 months). The regression analysis revealed that, holding prior kindergarten experience and teacher in-service training constant, each month of student age was associated with an increase of 1.32 scale score points on pretest reading achievement. For the purposes of the cost effectiveness analysis, the increase of 1.32 scale score units per month was treated as an exact measure of increase on the same instrument from the time of pretesting to the time of posttesting. Therefore, a net increase in reading achievement of 9.24 scale score points would be expected over a period of seven months as a result of maturation with school experience excluded.

The second stage of the cost effectiveness analysis entailed the identification of the factors involved in reading achievement and the amount of reading achievement accounted for by each factor. The control class size group, which contained an average of 26.7 students per class, increased on an average of 61.9 reading scale score points per student. Of the 61.9 increase in scale score points, 9.24 scale score points were attributable to the expected increase in reading achievement with school experience excluded, and 52.7 scale score points were attributable to school experience alone. The achievement of the experimental class size group, which contained

an average of 19.9 students, increased on an average of 76.7 reading scale score points per student. A breakdown of this achievement increase indicated that 9.24 scale score points were attributable to maturation, 52.7 scale score points were attributable to school experience, and the remaining 14.8 scale score points were attributable to the reduction in class size or the experimental intervention.

The third stage of the cost effectiveness analysis investigated whether the increase in reading achievement was sufficient to warrant additional increases in expenditures. The determination of cost effectiveness was accomplished through the utilization of the ratio of the cost for funding additional reading teachers to the resultant benefit in terms of increased reading achievement. In order to apply costs to increases, estimates of population means and other parameters were treated as exact measures. In other words, the standard errors of these parameters were assumed to be zero.

The cost for funding additional reading teachers was defined as the proportion of teacher salary spent for reading instruction during the implementation of the reduction in class size divided by the proportion of teacher salary spent for reading instruction prior to the implementation of the reduction in class size. These two proportions were assumed to be identical; therefore, the cost factor was simply the quotient of teacher salary during the implementation of the class size and teacher salary prior to the implementation of the reduction in class size. A second assumption was that additional teachers would receive the same average salaries as current first grade teachers. A third assumption was that the minimum instructional time in reading would be expended in all first grade classes as

prescribed by the Defined Minimum Program as adopted by the South Carolina State Board of Education. On the basis of these three assumptions, the cost factor for funding additional teachers was calculated to be 1.34. This factor was actually the quotient of the average large class size divided by the average small class size.

Achievement was defined as the increase in reading achievement for the experimental group divided by the increase in reading achievement for the control group. These achievement increases were restricted to those increases which required expenditures of additional funds, that is, those increases which resulted from school experience and the reduction of class size. Thus, the achievement benefit factor was 1.28 (67.5 ÷ 52.7).

The cost effectiveness was determined by calculating the ratio of the cost factor for funding additional teachers (cost) to the achievement benefit factor (benefit). This ratio was 1.05 (1.34 ÷ 1.28). The fact that the cost/benefit ratio exceeded 1.00 indicated that an increase of one scale score unit cost five percent more per student for the reduced class size than for the "normal" class size.

However, the net reading achievement per first grade student increased 28% [(1.28 - 1.00) X 100] under the implementation of the reduced class size policy. Overall, the funds for the additional teaching positions that would be necessary to reduce the class size would increase by 35%. The algorithm for calculating the 35% fund increase for additional teachers is given subsequently:

$$\frac{\text{(Control Average Class Size - Experimental Average Class Size)}}{\text{Experimental Average Class Size}} \times 100$$

or

$$\frac{(26.7 - 19.9)}{19.9} \times 100$$

This 35% increase in funds does not include the capital that would be necessary for the building of additional classrooms. If the net reading achievement per first grade student had increased 35% as opposed to 28%, then the reduction in class size would have been considered cost effective. Nevertheless, a net increase of 28% in reading achievement is still a substantial increase and is encouraging in view of the fact that most innovations undergo an adjustment period. This increase reflects student performance on a standardized measure of reading achievement during the project's first year of implementation.

Implications

The primary purpose of the South Carolina First Grade Pilot Project 1975-76 was to examine the effects of class size on reading and mathematics achievement of first grade pupils. The secondary purpose was to examine the effects of teacher in-service training on the achievement of first grade pupils. The study revealed that the reduction of class size caused an increase in mean reading achievement but did not cause an increase in mean mathematics achievement. These results are consistent with previous research findings in reading

and mathematics achievement (Barlow, 1969; Fuano & Collins, 1967; Taylor & Fleming, 1972).

Since the sample appeared to be widely representative of the first grade classes in the public schools of South Carolina, the results imply that a reduction in class size would cause an increase in reading achievement for first graders. However, the evidence is insufficient to justify an expectation of increased achievement in mathematics.

No consistent effect of teacher in-service training on student achievement in reading or mathematics was identified. Although teacher in-service training in the experiment was unrelated to student achievement, the results from this experiment do not provide sufficient evidence to infer that teacher in-service training is generally unrelated to student achievement. Therefore, the results of the experiment with respect to teacher in-service training are at best ambiguous and should be generalized with caution.

The finding of an interaction effect of class size and teacher in-service training upon class achievement in reading is consistent with widely held commitments among teachers (Perrimon, Bowen, Payne, & Johnson, 1976).

Decreasing the size of first grade classes across the State of South Carolina will increase the cost of operating the first grade. A reduction from 26.7 pupils to 19.9 pupils, as in this experiment, would increase teacher salaries for first grade by approximately 35%. Against this increased cost, the expected increase in per pupil reading achievement as a result of reducing class size should be 28%.

Increases in achievement within other subject areas may also accrue, but this experiment was unable to provide evidence of such an increase. No widely recognized decision rule for recommending whether to reduce the size of first grade classes exists; ultimately, the decision must be based upon human judgement. The pilot project demonstrated that the reading achievement of first graders was increased as a result of reducing class size. Policy makers must now decide if, in fact, this increase is large enough to warrant the financial investment. Additional information which may affect such decisions will be forthcoming from the second year evaluation of the project which is now in progress.

As with most research, this experiment highlights the need for additional research. Examples of research questions in need of study follow:

1. What is the effect of reduced class size on achievement of students beyond the first grade?
2. What is the effect of further reduction of class size on achievement of all students?
3. What types of teacher in-service training, if any, are related to increased achievement of students?
4. Within the reduced class size, what teaching strategies are related to increased achievement?
5. What is the differential effect of reduced class size on school achievement for low, average, and high achieving students?
6. What pupil grouping patterns are related to increased school achievement of students in small class sizes?
7. What cost implications for public education ensue from improved reading achievement of students in first grade?

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APPENDIX A

South Carolina First Grade Pilot Project 1975-76

Procedures and Impact

SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1975-76

Procedures and Impact

1. There will be 28 experimental and 28 control classes involved in the project. Where possible, experimental classes should contain 21 pupils and control classes 29 pupils. If local conditions are such that this is not feasible, determine the average first grade size (based on enrollment) in the district and establish the experimental class at 23% less than the district average; add to this an appropriate number of students, based on local attendance rates, to provide reasonable assurance of the desired ADA. The control class should also have sufficient students to achieve an ADA approximately equal to the average first grade class size in the district.

2. Control and experimental classes should be located in the same building. If this is not feasible and it is necessary to locate the classes in separate schools, the schools should be matched on at least:

   a) racial composition of student body
   b) socio-economic background of students
   c) curriculum and instruction

3. The children in each control and experimental class should be randomly assigned from all non-special education first graders in the school. If this is not possible, document the method of selection that is used.

4. The teachers in each project class should be randomly assigned from those first grade teachers currently on the school's faculty.

5. Once the teachers and children are assigned, there should be no administrative transfer of any teacher or student involved in the study.

6. If any students in these project classes should drop out during the year, they may be replaced by newly entering students in the same manner in which such assignments are normally made in that school. The original class size, however, may not be exceeded at any time during the year.

7. In addition to pre- and post-test data certain other information may be gathered by means of a teacher survey or from the school records. As a minimum the supplementary data will include attendance rates for teachers and students in the control and experimental groups.

8. A pre-test will be given to all project students. The pre-test shall be given PRIOR to any other test that will be given to the children in the project. A post-test will also be given toward the end of the year. This test will precede any locally administered test in the spring.

9. The total testing time required for the pre-test will be approximately 3 hours spread over 4 or 5 testing periods, i.e., 2 or 3 morning sessions and 2 afternoon sessions. The post-test will require approximately the same schedule.

10. The two teachers in each selected school will administer the pre- and post-tests to the children. Three or four proctors will be needed in each testing session (3 for experimental classes and 4 for control classes). It may be necessary for all project teachers, and any

proctors who can, to attend a training session conducted by the Department, one for pre-test and one for post-test. They will be instructed in test administration procedures. Any proctors not able to attend a scheduled session will be given instructions by the TEACHER involved. It will be the district's responsibility to acquire proctors for the classes.

11. The following is the suggested procedure to be used in assigning students to the first grade classes involved in this project.

a) Place each first grader's name on a small slip of paper. Include ALL non-special education first graders in the building.

b) Place all of the slips of paper containing the names of students into a container (waste basket, hat, etc.).

c) Have a small child draw 21 slips from the container (shake the container before each drawing). The children whose names are on the first 21 slips shall be assigned to the experimental class.

d) In the same manner, select 29 more slips. These 29 designated children shall be assigned to the control class.

e) Assign the remaining first graders to other classes as is normally done in the school.

Remember, the results of this study may affect future Legislative action.

12. There must be consistency in the utilization of teacher aides. Either BOTH experimental and control classes in the school WILL have an aide or BOTH WILL NOT.

13. The following information will be required for <u>each experimental and control class</u>:

a) Name of building in which located (8/29/75)

b) Name of teacher (8/29/75)

c) Roster of students at time of pre-test

d) Roster of students at time of post-test

14. Each school selected will need to designate a contact person (principal, instructional leader, etc.) who will work and communicate DIRECTLY with the Department of Education. THE CONTACT PERSON WILL BE RESPONSIBLE FOR THE INTEGRITY OF THE EVALUATION EFFORT OF THIS PROGRAM IN HIS OR HER BUILDING. (8/29/75)

15. The project teachers (at least 1/2 those with experimental classes) will be required to participate in an inservice training effort that will be implemented by the State Department of Education.

16. The Department will designate the pre- and post-test instruments to be used and will supply the necessary materials to the districts for use in the control and experimental classes.

17. Tests will be administered on dates to be designated by the Department.

18. Each district allocated an experimental class will submit a description of the procedures used in accomplishing items 1, 2, 3, 4, 11, and 12 on the preceding pages. Additionally, the information called for in Items 13a, 13b, and 14 will be submitted on the form provided by the State Department of Education. Information specified in items 13c and 13d will be submitted at the times of the pre- and post-tests respectively.

APPENDIX B

First Grade Project Questionnaire

Spring, 1976

FIRST GRADE PROJECT QUESTIONNAIRE
SPRING 1976

Teacher: _____

School: _____

District: _____

Date: _____

Return by
March 31, 1976
to:

S. C. Department of Education
Educational Assessment Section
Rutledge Building
Room 604
Columbia, S. C. 29201

Part I: Please answer the following questions:

1. On the AVERAGE, how often during the school year have you received assistance from a teacher's aide? Check one response only.

   _____ None of the time
   _____ Once a week or less
   _____ 2 to 3 days per week
   _____ 4 to 5 days per week

2. Between September 30, 1975 (administration of pretest) and May 3, 1976 (administration of posttest), Have your first grade students been tested or will they be tested with a published test? Check one response only.

   _____ Yes
   _____ No

3. If your answer to Question 2 is "Yes", please write the name of the test, the level of the test, and when it was or will be administered.

   Name of Test: _____

   Level of Test: _____

   Administration Date: _____

Part II: On the following page spaces are provided for you to list the names of each student in your first grade class. For each student, please fill in the student's sex, birth date, title I classification, and prior kindergarten experience. For the purpose of this project "kindergarten experience" will be defined as planned educational experience below the first grade level, whether public or private school. Excluded will be all day care centers, nursery schools, church schools, and other institutions, whose activities, although perhaps educational in effect, are not specifically planned and designed as educational.

Student names will be used only for the purpose of precoding data on test materials prior to utilization. Confidentiality of student identification will be maintained.

	Student's Full Name	Sex	Birth Date Mo-Yr.	Is this student classified as "Title I"?	Did this student have prior kindergarten experience?
1.		M F		Yes No	Yes No
2.		M F		Yes No	Yes No
3.		M F		Yes No	Yes
4.		M F		Yes No	Yes No
5.		M F		Yes No	Yes No
6.		M F		Yes No	Yes No
7.		M F		Yes No	Yes No
8.		M F		Yes No	Yes No
9.		M F		Yes No	Yes No
10.		M F		Yes No	Yes No
11.		M F		Yes No	Yes No
12.		M F		Yes No	Yes No
13.		M F		Yes No	Yes No
14.		M F		Yes No	Yes No
15.		M F		Yes No	Yes No
16.		M F		Yes No	Yes No
17.		M F		Yes No	Yes No
18.		M F		Yes No	Yes No
19.		M F		Yes No	Yes No
20.		M F		Yes No	Yes No
21.		M F		Yes No	Yes No
22.		M F		Yes No	Yes No
23.		M F		Yes No	Yes No
24.		M F		Yes No	Yes No
25.		M F		Yes No	Yes No
26.		M F		Yes No	Yes No
27.		M F		Yes No	Yes No
28.		M F		Yes No	Yes No
29.		M F		Yes No	Yes No
30.		M F		Yes No	Yes No
31.		M F		Yes No	Yes No
32.		M F		Yes No	Yes No
33.		M F		Yes No	Yes No
34.		M F		Yes No	Yes No
35.		M F		Yes No	Yes No

SDE 33-068-00
(This form becomes obsolete 6/30/76)

APPENDIX C

South Carolina First Grade Pilot Project 1975-76

Summary of Teacher In-Service Training Sessions

SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1975-76

Summary of Teacher In-Service Training Sessions

As part of the South Carolina First Grade Pilot Project 1975-76, eight inservice training sessions were held for the project teachers. An important part of each program was a sharing session in which each teacher presented materials, ideas, and activities which might be used effectively by the other teachers in the project. Primarily, staff for the programs were consultants from the Curriculum Development Section, Office of General Education. A brief description of each of the in-service sessions follows:

1. At the initial meeting, a general orientation to the project and the project objectives were presented to all teachers and curriculum consultants involved. In addition, an assessment was made of concerns which the teachers had in regard to their effectiveness in classroom teaching. Their concerns were listed and placed into priority, and the year's program of inservice was designed to provide professional help in meeting each of those identified needs. An evaluation instrument was also developed and reviewed at this general orientation meeting.

2. This session emphasized the three areas of reading, writing, and elementary math, all of which were identified by the teachers as their top priority need. Consultants from the Curriculum Development Section led the workshop in each area and included Miss Mary Kelly, Dr. Tom Parks, and Mr. Dan Sandel. Specific attention was paid to precise points of student weaknesses identified by the teachers in these three areas.

3. Teachers in the project expressed a special desire for in-depth experience with their textbooks in math and reading. Accordingly, national consultants were called in from the publishers of the textbooks involved, and these consultants provided the comprehensive and specific orientation to improved textbook use for the first grade teachers.

4. Classroom management was listed as one of the special priority needs of the classroom teachers. This session, therefore, emphasized instructional strategies, classroom management approaches, and such activities as individualized instruction, grouping, and classroom dynamics. In addition to curriculum consultants, Mr. Ron West of the elementary unit in the Accreditation and Educational Improvement Section was featured.

5. Improved use of audio-visual materials and supportive supplies was emphasized at this session in accord[illegible] with requests by the teachers. Included were instructions and experience in the preparation of audio-visual materials, ideas for utilization, as well as general concepts for effective use of supplementary materials. This included Instructional Television, overhead transparencies, and duplicated materials with emphasis on teacher-made materials.

6. The supportive areas of physical education and health were emphasized at this session, with special attention to the coordination of instruction among different subject areas. For example, the coordination between psycho-motor skills and reading skills was featured. Consultants for this session included Mr. Harold Schreiner, Dr. Vincent Granell, and Mrs. Alice Linder.

7. Consultants in art and music provided teachers with supportive activities and classroom ideas for enhancing basic skills instruction through the arts. Consultants included Mr. Tom Hatfield and Dr. Don Lauder.

8. At this final session, teachers and consultants reviewed the year's inservice activities, discussed implementation of ideas and concepts presented, and evaluated the effectiveness of the materials and programs presented.

APPENDIX D

List of Symbols

LIST OF SYMBOLS

Symbol	Definition
M	Mean
df	Degrees of Freedom
SS	Sums of Squares
MS	Mean Square
F	F - ratio
p	Probability
n	Sample Size

- END -